



Figure 8. Frame model of Northampton County Bridge using equivalent lengths from Robinson et al. (2006)

The equivalent model, described above, allows the designer to better predict the demands on the overall pile bent structure. While not as versatile as the non-linear soil pile analyses performed in SAP and MultiPier, the equivalent frame analysis allows the designer to capture some of the nonlinear response while maintaining some of the current analysis practices in place at NCDOT.

Limit States

The limit states used by NCDOT were investigated in Robinson et al. (2006). For piles and shafts design, the size of the foundation element is often dictated by the lateral displacement under the assumed lateral load. In NCDOT's case, the lateral displacement of the pile has been limited to one inch. Several studies on the matter were examined, including Moulton's 1986 field survey of 314 bridges from 39 states. Damage to some part of the bridge structure was recorded, as was any observed movement of substructures. Moulton's general observations are summarized in Table 1.